
DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

Local Operations Model for Oroville-Thermalito Complex

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Briefing Overview

- Needs of a Local Operations Model (LOM)
- Requirements for the LOM
- LOM Development
- Next Steps

Needs of a Local Operations Model

- Support Oroville Relicensing Process
- Simulate hourly operation of Oroville-Thermalito Complex for hydropower generation
- Provide hourly operation details for other analyses
  - River and reservoir temperature studies
  - Fishery studies
  - Other studies require information on hourly operation

Requirements for LOM

- Simulate operation on planning level consistent with CALSIM II
- Produce optimized hourly power generation and reservoir operations on a weekly basis.
  - Hyatt PP and Thermalito PP including pump-back operation

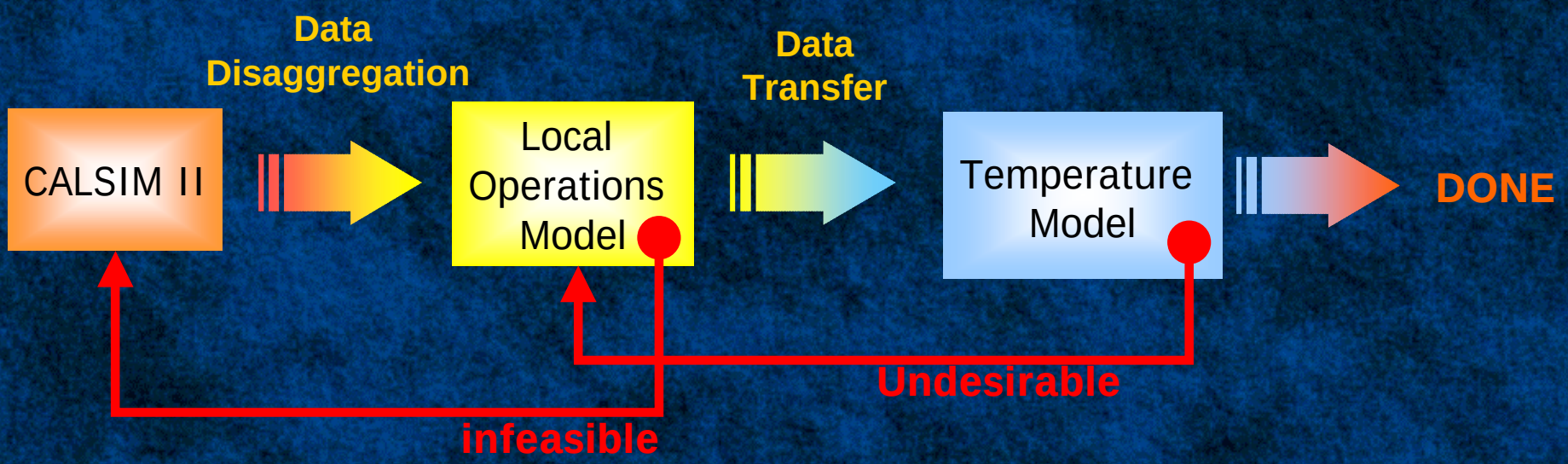
Requirements for LOM (Contd.)

- Observe applicable operation regulations and guidelines including
  - Physical limitations
  - Flood control diagram
  - Stage fluctuation limitations
  - Instream flow and temperature objectives
  - Flow fluctuation and ramping limitations

Requirements for LOM (Contd.)

- Optimize operation for multiple competing objectives including
  - Minimize the deviation from desired schedule
  - Minimize the deviation from target storage
  - Minimize spill and flood release
  - Minimize the deviation from target flow release and downstream temperature
  - Maximize energy revenue (value)

Flowchart for a Complete Planning Scenario Run



- Water supply condition
- Monthly operation and water budget

- Power generation
- Hourly operation

- Reservoir temperature
- River temperature

LOM Development Team

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SWRI SURFACE WATER RESOURCES, INC.

Bill Smith

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Yung-Hsin Sun

POWEL

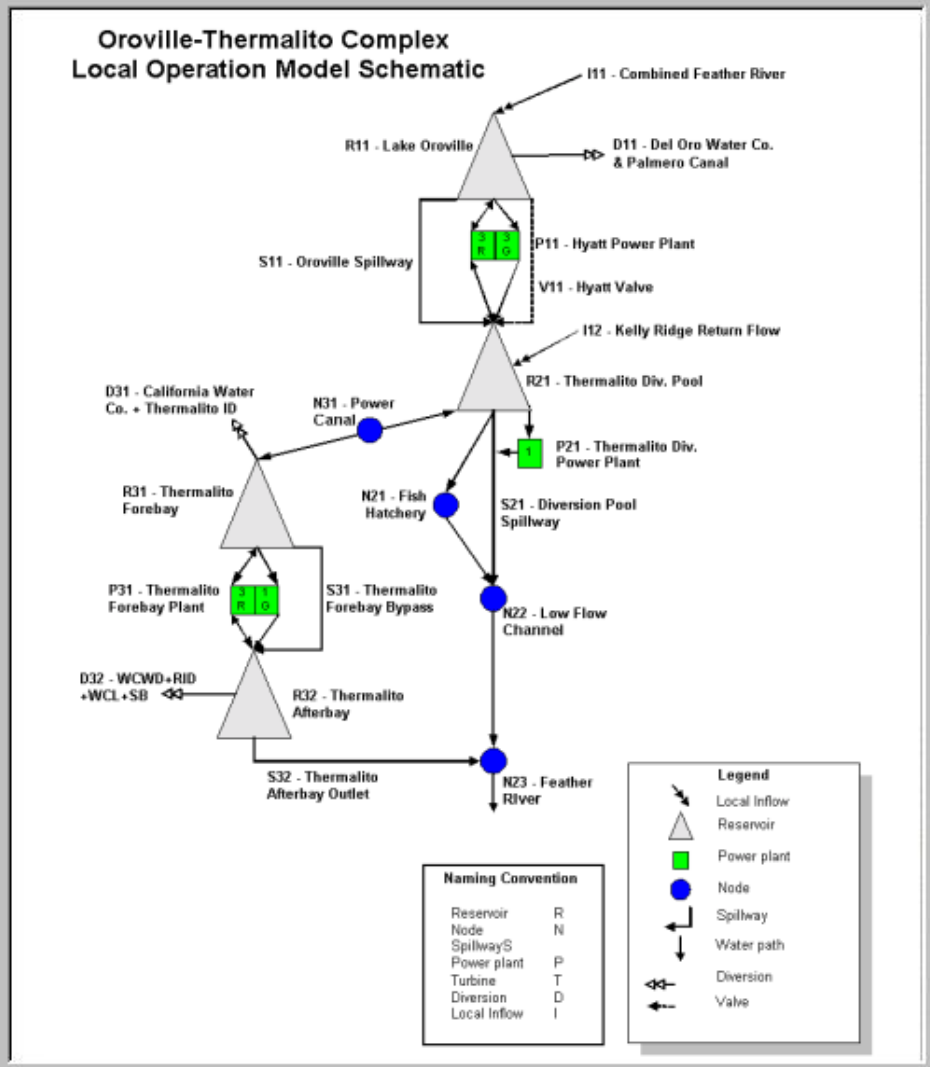
Tung Van Do

LOM Development

- LOM – HYDROPS
- Scenario and Version Concept
  - Allow users to create and save many study scenarios with minimal data entry.
  - A scenario is a collection of versioned input data of various data types and the optimized results.
  - A version is a dataset for one input data type.
- Convenient User Interface
  - Example: Input screen

File Options Tools Windows Help

Schematic



System

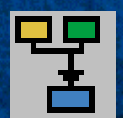
Oroville-Thermalito Complex

Oroville-Thermalito Complex

	Location	Property	Value	
Oroville-Thermalito		Drainage Area	3611	sq mi
Lake Oroville	Lake Oroville	Reservoir Area	1,344	acres
		Max. Usable Storage	3,485.59	TAF
		Normal Max. Level	900.00	ft
		Normal Max. Drawdown	260.00	ft
	Hyatt Power Plant	Generation Capacity	645.0	MW
		Hydraulic Capacity	16950	cfs
Thermalito Diversion	Thermalito Div. Pool	Reservoir Area	320	acres
		Max. Usable Storage	15.36	TAF
		Normal Max. Level	226.00	ft
		Normal Max. Drawdown		
	Thermalito Div. Plant	Generation Capacity		MW
		Hydraulic Capacity		
Thermalito Forebay	Thermalito Forebay	Reservoir Area	57	
		Max. Usable Storage	.78	TAF
		Normal Max. Level	226.00	ft
		Normal Max. Drawdown	6.00	ft
	Thermalito [illegible]	Generation Capacity	114.0	MW
		Hydraulic Capacity	17400	cfs
[illegible]	Thermalito Afterbay	Reservoir Area	4,544	acres
		Max. Usable Storage	81.73	TAF

Scenario | Default Scenario | Starting Date | Jan 01, 1953 | Ending Date | Dec 31, 1953 | Scenario Status | Unoptimized

LOM Input Screen Toolbar Functions



System selection

Scenario Design

Starting & Ending Conditions

Operating Constraints

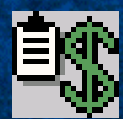
Ramping Rate Constraints

Soft Constraints Prioritization

Turbine Maintenance Schedule

Local Inflow Selection

Energy Price Schedules



Energy Price Assignment

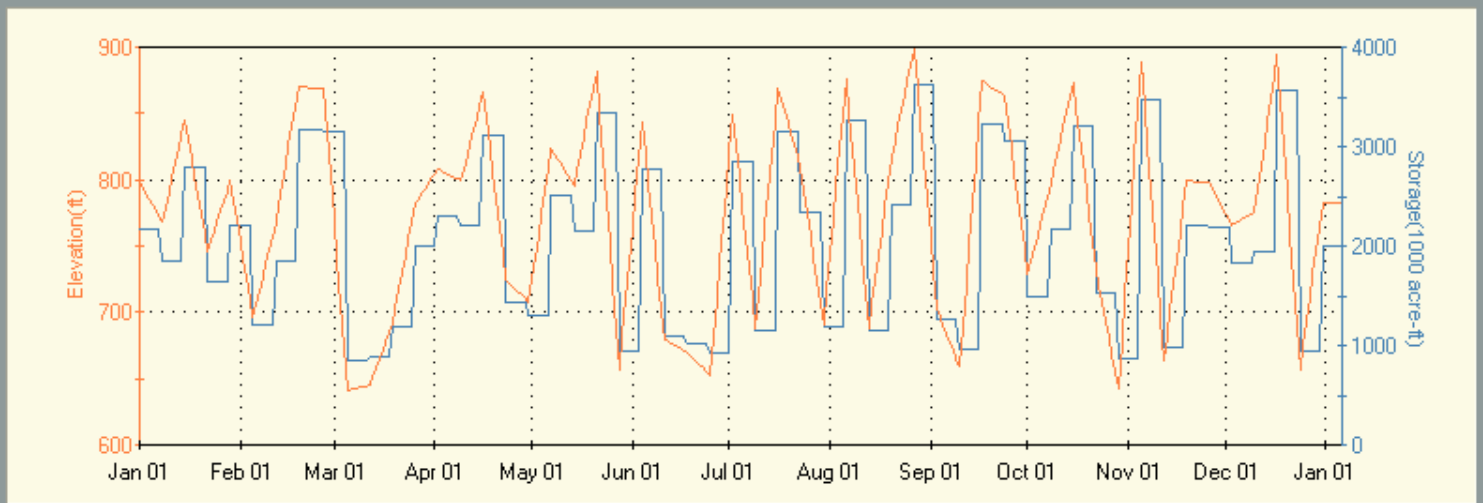
LOM Outputs

- Model Outputs
  - Hourly reservoir level and storage at all reservoirs
  - Hourly generating flow at all turbines and powerhouses
  - Hourly pump-back flow at all reversible turbines
  - Hourly generation at all turbines and powerhouses
  - Hourly spill and Hourly river valve bypass flow
  - Hourly revenue at all powerhouses
  - Total and weekly power at all powerhouses
  - Hourly Feather River flows in the Complex

Results Comparison by Data Type

Inflow Year: 1992 (Optimized short term (hourly))

Weekly Elevation and Storage



Data Type

- [x] Elevation — Lake Oroville
- [x] Storage — Lake Oroville
- [ ] Local Inflow — Lake Oroville
- [ ] Target Flow/Diversions — Feather River
- [ ] Generating Flow — Hyatt Power Plant
- [ ] Generation — Hyatt Power Plant
- [ ] Pumpback Flow — Hyatt Power Plant
- [ ] Spill — Oroville Spillway
- [ ] Value — Hyatt Power Plant

Data Comparison Results

		Jan 01 1992	Jan 08 1992	Jan 15 1992	Jan 22 1992	Jan 29 1992	Feb 05 1992	Feb 12 1992
Elevation (ft)	Lake Oroville	798.88	768.00	845.00	746.00	799.00	696.00	
Storage (TAF)	Lake Oroville	2,179.13	1,855.46	2,794.69	1,638.10	2,198.48	1,216.69	1,845.
Local Inflow (cfs)	Lake Oroville	1339	1339	1339	2494	5384		
Target Flow/Div. (cfs)	Feather River	100	100	100	100	100		100
Generating Flow (cfs)	Hyatt Power Plant	13630	15820	949	9487	4513		624
Pumpback Flow (cfs)	Hyatt Power Plant	00	00	00	00	00		00
Generation (MWh)	Hyatt Power Plant	90,216	20,496	26,040	60,480		6,720	94,584
Spill (cfs)	Oroville Spillway	0.0	0.0	0.0		0.0	0.0	0.0

Display
- Weekly
- Hourly — Jan 01

Scenario	Test Run 1	Starting Date	Jan 01, 1992	Ending Date	Dec 30, 1992	Scenario Status	Optimized long term

Turbine Results

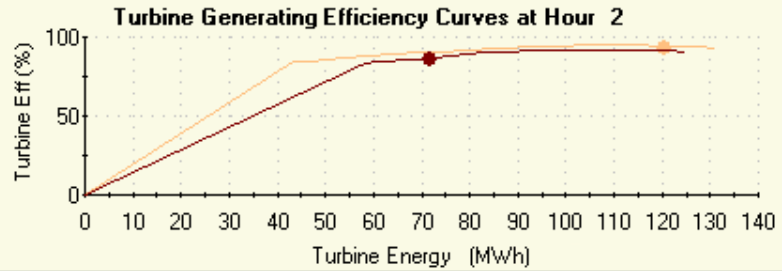
Energy (MWh) at Hyatt Power Plant for Wednesday, Jan 1, 1992

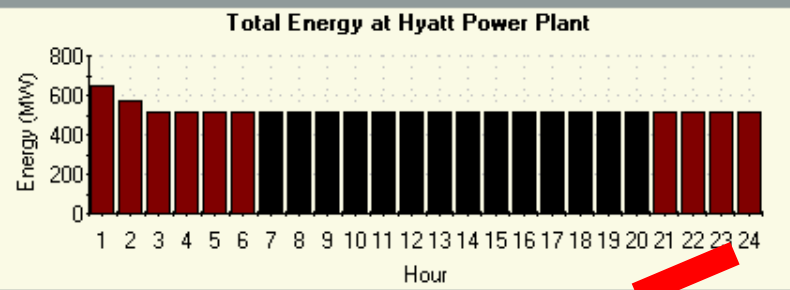
Inflow Year: 1992 (Optimized short term (hourly))

Energy | Flow | Efficiency

Hour	Unit 1	Unit 2	Unit 3	Unit 4	Total
00 - 01	130.0	85.00	130.0	85.00	645.0
01 - 02	120.0	70.00	120.0	70.00	570.0
02 - 03	100.0	70.00	100.0	70.00	510.0
03 - 04	100.0	70.00	100.0	70.00	510.0
04 - 05	100.0	70.00	100.0	70.00	510.0
05 - 06	100.0	70.00	100.0	70.00	510.0
06 - 07	100.0	70.00	100.0	70.00	510.0
07 - 08	100.0	70.00	100.0	70.00	510.0
08 - 09	100.0	70.00	100.0	70.00	510.0
09 - 10	100.0	70.00	100.0	70.00	510.0
10 - 11	100.0	70.00	100.0	70.00	510.0
11 - 12	100.0	70.00	100.0	70.00	510.0
12 - 13	100.0	70.00	100.0	70.00	510.0
13 - 14	100.0	70.00	100.0	70.00	510.0
14 - 15	100.0	70.00	100.0	70.00	510.0
15 - 16	100.0	70.00	100.0	70.00	510.0
16 - 17	100.0	70.00	100.0	70.00	510.0
17 - 18	100.0	70.00	100.0	70.00	510.0
18 - 19	100.0	70.00	100.0	70.00	510.0
19 - 20	100.0	70.00	100.0	70.00	510.0
20 - 21	100.0	70.00	100.0	70.00	510.0
21 - 22	100.0	70.00	100.0	70.00	510.0
22 - 23	100.0	70.00	100.0	70.00	510.0
23 - 24	100.0	70.00	100.0	70.00	510.0
Total	2,450	1,695	2,450	1,695	12,435

Generating | Pumping





Hour 1 — Hour 24

Location

- Hyatt Power Plant
- Thermalito [illegible] Plant

Starting Jan 01, 1992

- Wednesday
- Thursday
- Sunday
- Friday
- Monday
- Saturday
- Tuesday

Scenario	Test Run 1	Starting Date	Jan 01, 1992	Ending Date	Dec 30, 1992	Scenario Status	Optimized short term (hourly)

Next Steps

Model Development Started
January 2003

Model Prototype Review
April 2003

Model Acceptance Test
and Training Session
May 8 and 9, 2003

Model Workshop
June 2003

Model Development

Production Runs

WE ARE HERE

E&O Work Group Meeting
Late April 2003

Local Operations Model for Oroville-Thermalito Complex

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